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**(71) Applicant(s)**  
**Adam Computers Limited**  
**(Incorporated in Ireland)**

**Ballybane Industrial Estate, Ballybane, Galway,  
Ireland**

(72) Inventor(s)  
Ian Quinn  
Niall Quinn

**(74) Agent and/or Address for Service**  
**Marks & Clerk**  
**57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS,**  
**United Kingdom**

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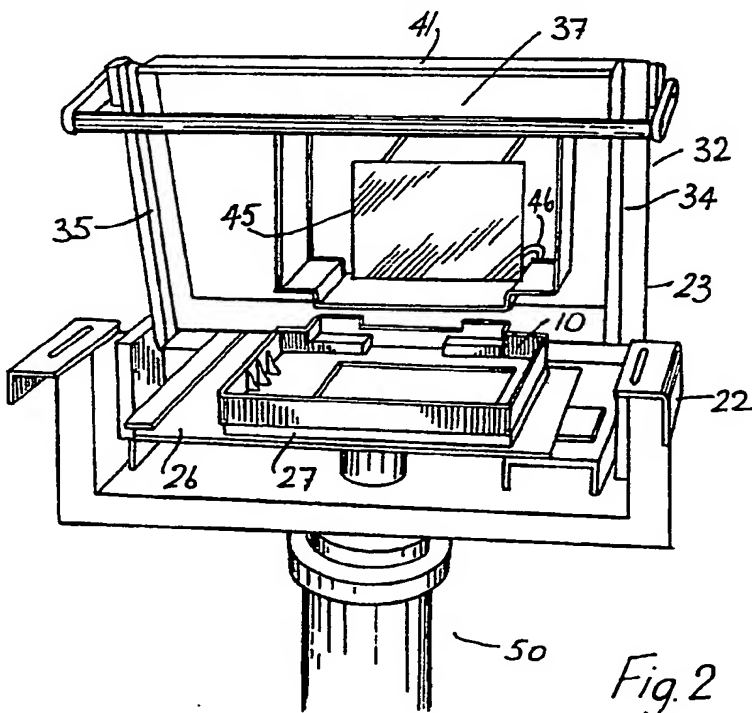
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**US 4535722 A**

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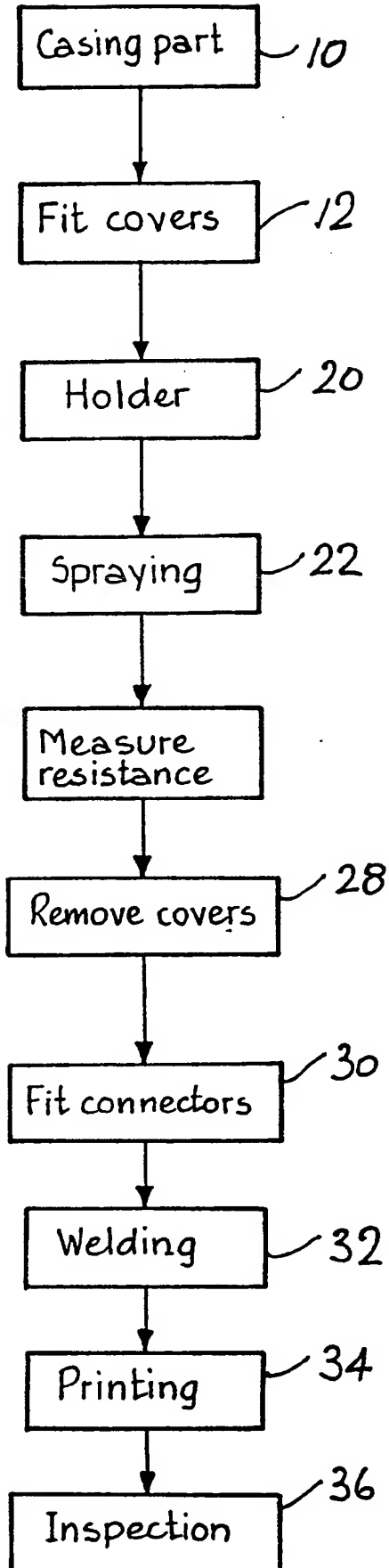
**(54) A method and apparatus for producing an EMI shielded plastic casing part for an electronic device**

(57) A method and apparatus for producing plastics casing parts with EMI shielding for electronic devices, the method includes rigidly clamping a casing part (10) in a holder (20) and then spray coating selected portions of an inner face (14) of the casing part (10) with a nickel-rich paint, opposite faces (12, 14) of the casing part (10) are engaged by a complementary inner face support (37) and exterior face support (27) on the holder (20), each casing part (10) is pulled into a desired uniform shape when it is clamped in the holder (20) to correct dimensional variations arising during moulding of the casing parts (10), at the same time, those portions of the casing part (10) which are not to be painted are covered.



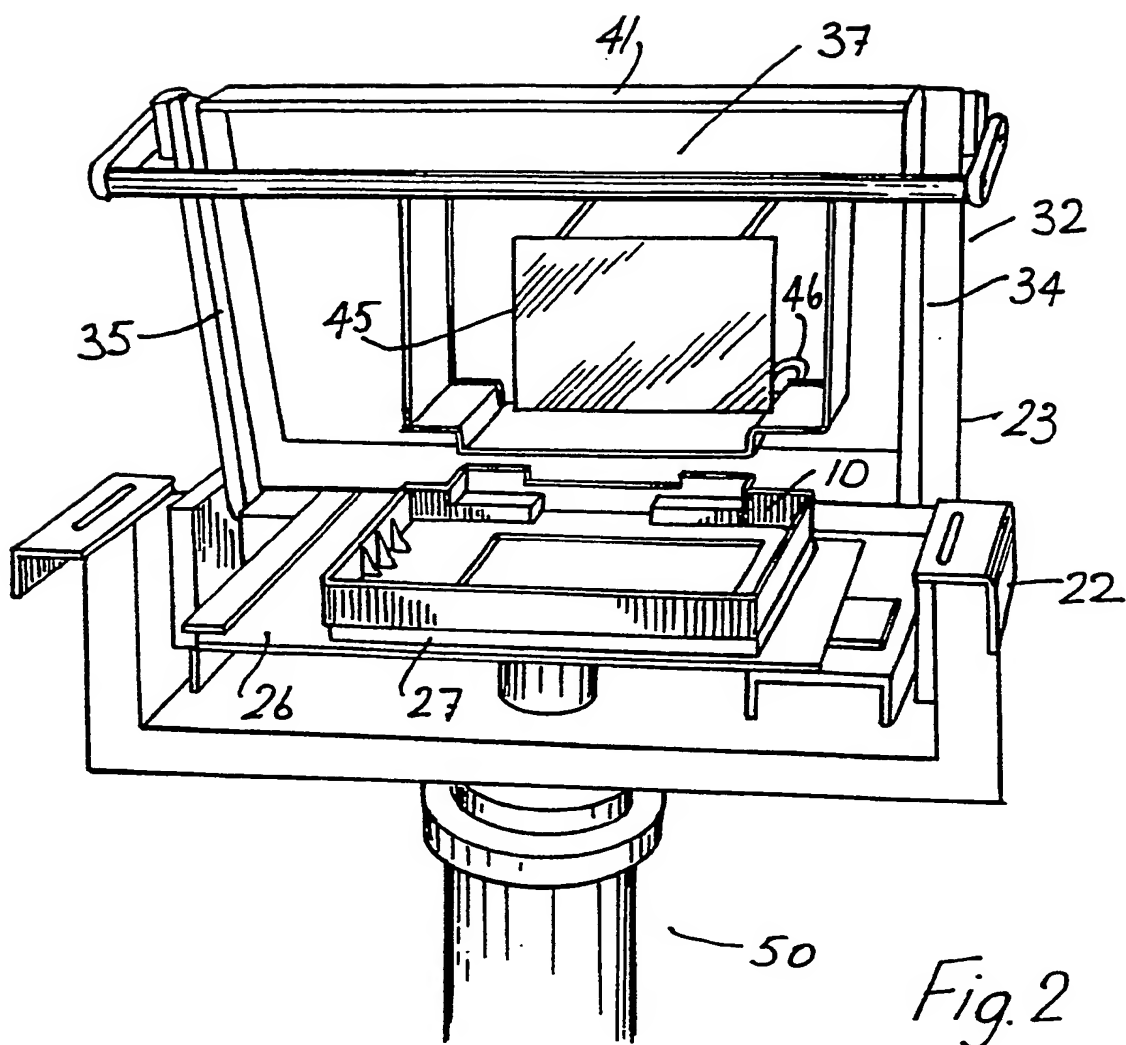
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*Fig.1*

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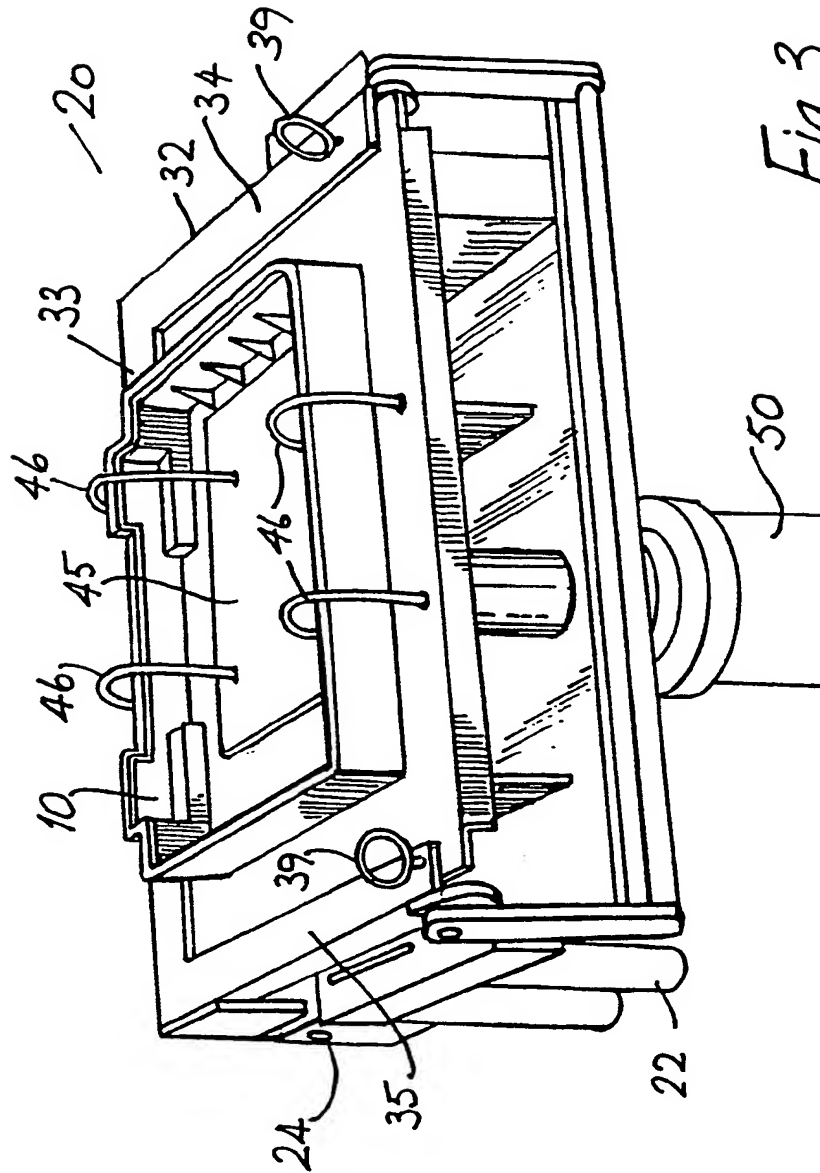


Fig. 3

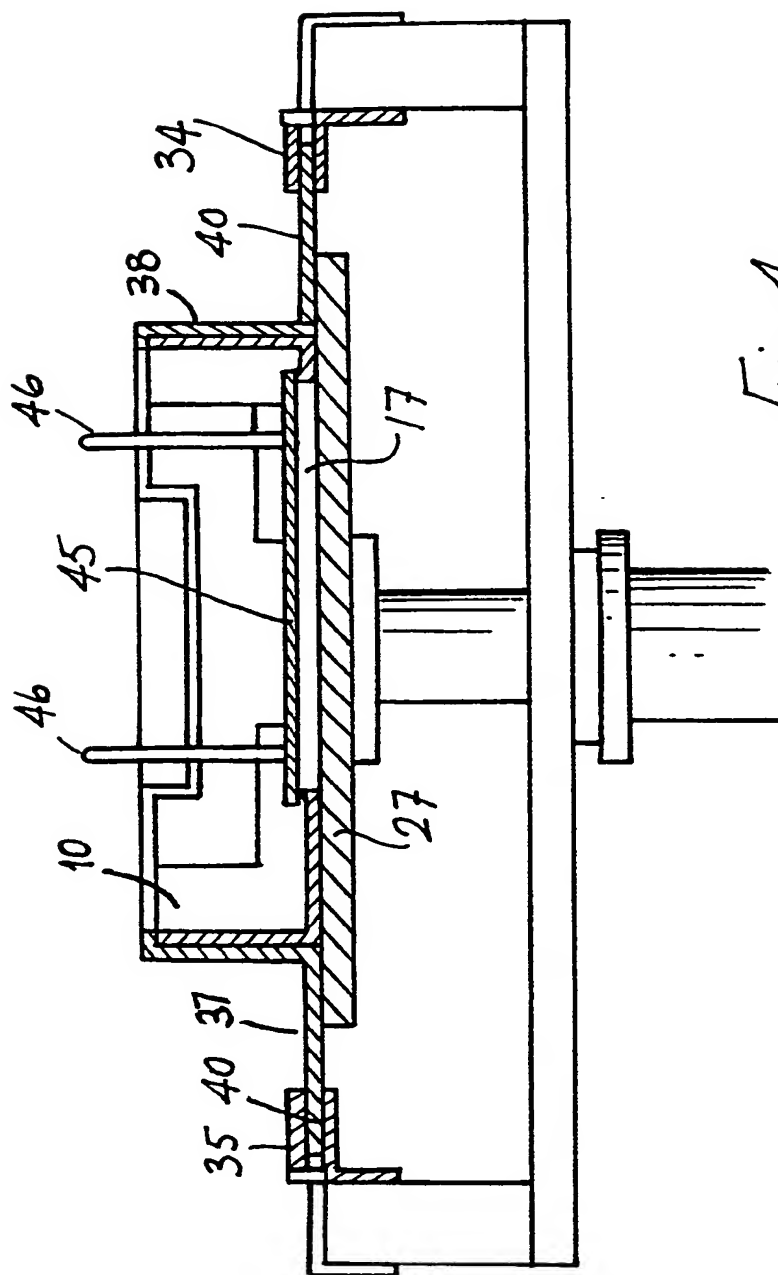
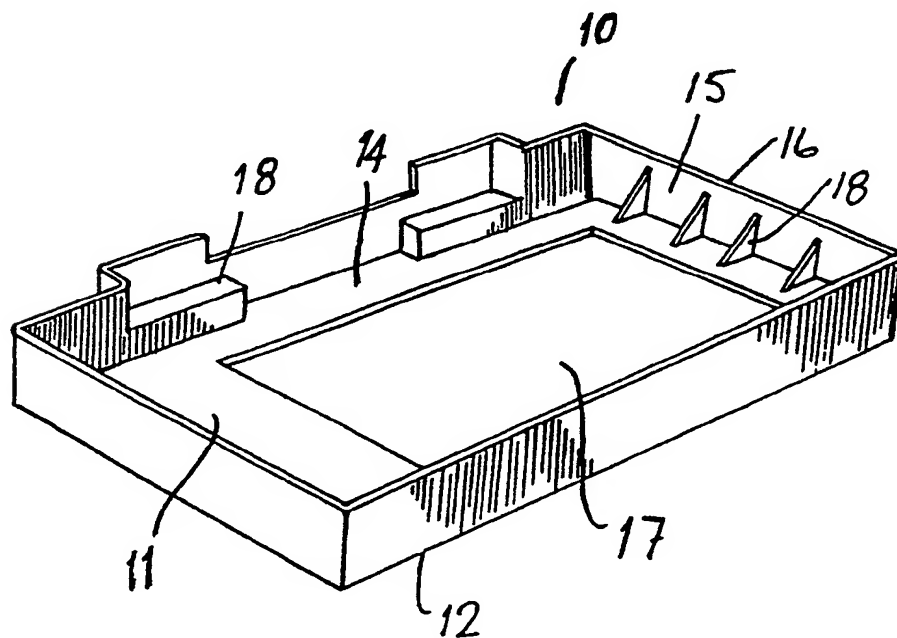
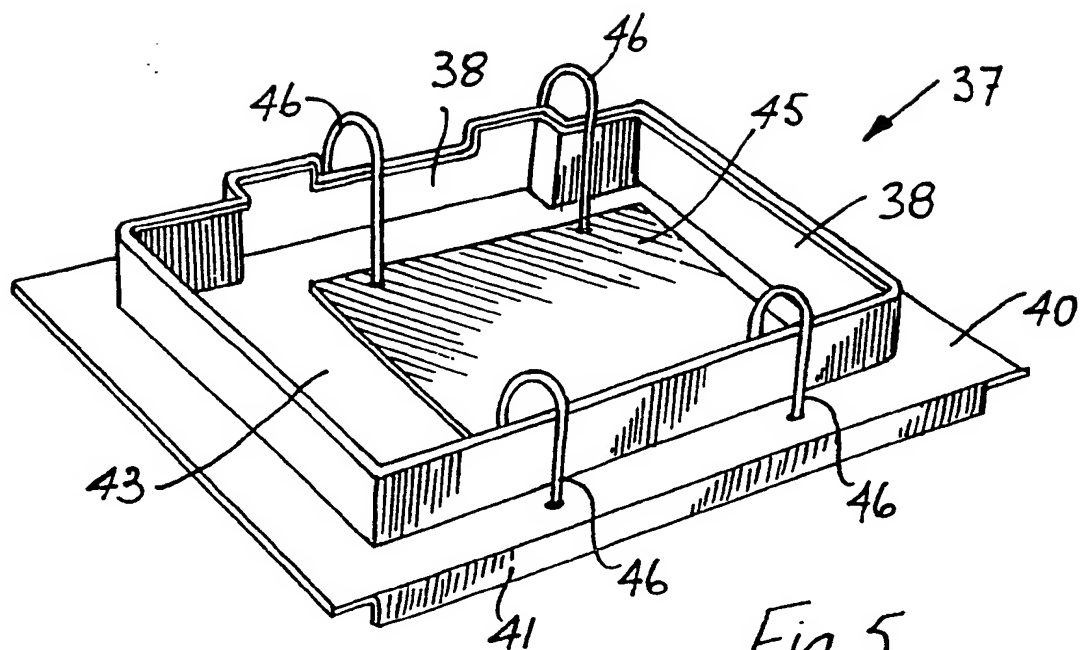


Fig. 4

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- 1 -

"A method and apparatus for producing an EMI shielded  
plastic casing part for an electronic device"

This invention relates to the production of casing parts with  
EMI shielding for electronic devices.

- 5 Many casings for electronic devices such as computers and the  
like are made of a moulded plastics material. The casings may  
be relatively thin-walled mouldings, and although apparently  
identical, can bear considerable changes in shape due to the  
moulding operation and the flexibility of the moulded casing.  
10 This can cause difficulties in further processing the casings  
and also during assembly of the electronic device.

- To prevent or limit the adverse effects of electro-magnetic  
interference during operation of the electronic device some  
form of EMI shielding is usually provided. This may, for  
15 example, be in the form of metal plates mounted within the  
casing. It is also known to coat an internal surface of the  
casing with a metal or some other suitable substance.

It is an object of the present invention to provide a method and apparatus for producing an EMI shielded plastic casing part for an electronic device in a manner which is both efficient and economical in operation.

5 According to the invention there is provided a method for producing an EMI shielded plastic casing part for an electronic device, comprising the steps:-

- 10 (a) mounting a plastic casing part in a holder with an exterior face of the casing part locating against a complementary shaped exterior face support on the holder,
- 15 (b) engaging an inner face of the casing part with a complementary shaped inner face support on the holder, the inner face support covering desired portions of the inner face of the casing part,
- (c) rigidly clamping the casing part on the holder between the inner face support and the exterior face support,
- 20 (d) spraying an electrically conductive paint onto exposed surface portions of the inner face of the casing part,



- (e) separating the inner face support and the exterior face support and removing the casing part from the holder,
- (f) drying the paint on the inner face of the casing part,
- (g) measuring the electrical resistance of the paint layer on the inner face of the casing part and rejecting any casing parts not having a preset desirable resistance value, and
- (h) inspecting the casing part for defects and packaging the casing part if it is of acceptable quality.

In one embodiment of the invention the method includes, after measuring the resistance value of the paint layer on the inner face of the casing part, the steps of mounting metal connectors onto associated spigots projecting outwardly of the inner face of the casing part then heating and flattening outer free ends of the spigots against the connectors to rigidly secure the connectors on the inner face of the casing part.

In a further embodiment the method includes the step of mounting protective covers over formations on the inner face of the casing part which are not to be painted prior to mounting the casing part in the holder, said covers being removed after resistance testing of the paint layer on the inner face of the casing part.

In a preferred embodiment of the invention, the electrically conductive paint is a nickel rich paint.

Preferably the method further includes the step of coating an outer side of the inner face support with a release agent prior to use of the holder, to facilitate subsequent removal of paint overspray from the inner face support.

In another embodiment the method includes the step of printing indicia on an exterior of the cover part prior to inspecting and packaging the cover part.

In another aspect the invention provides apparatus for carrying out the method as described above including a holder comprising a rigid frame having a bottom portion and a top portion connected together by a hinge along one edge for movement between a closed position in which the top portion overlies the bottom portion and an open position, means for releasably mounting an exterior face support on the bottom

portion, means for releasably mounting an inner face support on the top portion, and means to clamp the top portion against the bottom portion in the closed position to rigidly hold a casing part between the face supports.

- 5 In a preferred embodiment the mounting means for the exterior face support is pivotally mounted on the bottom portion of the frame for pivoting about an axis which is substantially parallel to the axis of the hinge between the top portion and bottom portion.
- 10 Conveniently, the mounting means for the exterior face support may be height adjustable on the bottom portion.

- In a preferred embodiment the mounting means for the inner face support is a channel-section receiver of U-shaped construction having a back part with two spaced-apart
- 15 outwardly extending sides, an inwardly facing channel on the back part and sides for slidable reception of peripheral edges on three sides of an associated inner face support, and locking means to releasably lock the inner face support in engagement with the receiver.

The locking means may conveniently be provided by a pair of locking pins engageable with associated through-holes at outer ends of the sides and with an inner face support mounted in the receiver to rigidly secure the inner face support in engagement with the receiver.

Ideally, the locking pins are engageable with complementary through-holes in the inner face support to secure the inner face support on the receiver.

In a further embodiment the frame is pivotally mounted on a ground-engaging support for pivoting about a vertical axis.

The invention will be more clearly understood by the following description of an embodiment thereof, given by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a flow chart illustrating a method according to the invention,

Fig. 2 is a perspective view of a holder for a casing part used in carrying out the method, the holder shown in an open position,

Fig. 3 is a perspective view of the holder shown in a closed position,

Fig. 4 is an elevational, partially sectioned view of the holder having a casing part mounted therein,

Fig. 5 is a perspective view showing a support used with the holder, and

5        Fig. 6 is a perspective view of a casing part produced by the method.

Referring to the drawings, a method according to the invention for producing an EMI shielded plastic casing part for an electronic device will be described.

10       Referring initially to Fig. 6 a typical casing part 10 for an electronic device is shown. In this case, the casing part 10 has a generally rectangular body with a stepped wall 11 having an exterior face 12 and an inner face 14. A raised peripheral rim 15 extends around the wall 11, the rim 15 having a free  
15       outer edge 16. An opening 17 is provided in the wall 11 for reception of a television screen. Various formations 18 are provided on the inner face 14 for mounting connectors on the casing part 10 and for attachment of the casing part 10 to related casing parts upon assembly of the casing part 10 in  
20       an electronic device.

Referring now in particular to Fig. 1, each casing part 10 is delivered to a masking station 12 at which protective covers are mounted over those formations 18 on the inner face 14 of the casing part 10 which are not to be painted. The casing  
5 part 10 is then mounted in a holder 20 which is described in more detail with reference to Figs. 2 to 5 later. The casing part 10 is rigidly clamped in the holder 20 such that only those portions of the inner face 14 which are to be painted are exposed. At a painting station 22 an electrically  
10 conductive nickel-based paint is sprayed onto the exposed portions of the inner face 14 of the casing part 10.

When the painting is completed the casing part 10 is removed from the holder 20 and mounted together with a number of other painted casing parts 10 on a portable trolley, the paint on  
15 the casing part 10 being allowed to dry.

When the paint has dried, the electrical resistance of the paint layer on the inner face 14 of the casing part 10 is measured to ensure it falls within a preset desirable resistance value. The casing parts 10 falling outside the  
20 required resistance value can be returned to the holder 20 for re-spraying. The casing parts 10 with acceptable resistance values are delivered on the trolley to a stripping station 28 where the covers are removed from the formations 18 on the inner face 14 of the casing part 10.

Some of the formations 18 may be stepped spigots for mounting metal connectors on the inner face 14 of the casing part 10. The connectors are mounted on the spigots at a fitting station 30 and delivered to a welding station 32 where by heat staking  
5 outer free ends of the spigots are heated and flattened against the connectors to rigidly secure the connectors on the inner face 14 of the casing part 10.

If desirable, the casing parts 10 can then be delivered to a printing station 34 for printing indicia such as a logo or the  
10 like on the exterior face 12 of the casing part 10. Downstream of the printing station 34 the casing parts 10 are inspected at 36 for defects and casing parts 10 of acceptable quality are packaged for delivery to a customer.

Referring now in particular to Figs. 2 to 5, the holder 20 for  
15 the casing part 10 will be described. The holder 20 comprises a rigid frame having a bottom portion 22 and a top portion 23 connected together by a hinge 24 along rear edges of the bottom portion 22 and top portion 23 for movement between a closed position (Fig. 3) in which the top portion 23 overlies  
20 the bottom portion 22 and an open position (Fig. 2). A platform 26 is provided on the bottom portion 22 for releasably mounting an exterior face support 27 on the bottom portion 22. The platform 26 is pivotally mounted at each end by pivot pins (not shown) to the bottom portion 22 for  
25 pivoting about an axis which is substantially parallel to the

axis of the hinge 24 between the top portion 23 and bottom portion 22. This advantageously facilitates accurate alignment of the top portion 23 with the bottom portion 22 in the closed position. Fig. 2 shows a casing part 10 mounted on  
5 the exterior face support 27, the exterior face 12 of the casing part 10 seating against a complementary shaped top of the exterior face support 27.

The top portion 23 has a channel section receiver 32 of U-shaped construction. The receiver 32 has a back part 33 with  
10 two spaced-apart outwardly extending sides 34, 35. An inwardly facing continuous channel on the back part 33 and sides 34, 35 slidably receives peripheral edges on three sides of an associated inner face support 37. Locking pins 39 are engageable with through holes at outer ends of the sides 34,  
15 35 and with complementary through holes in the inner face support 37 to rigidly secure the inner face support 37 on the receiver 32.

Fig. 5 shows the inner face support 37 in more detail. The inner face support 37 has a body 38 shaped to correspond to  
20 the inner face of the casing part 10. It is shaped such that it is a close fit about the casing part 10 as shown in Fig. 4, and it can be seated against the edge 16 of the rim 15 of the casing part 10 to cover the edge 16 and press the casing part 10 against the exterior face support 27 thus clamping the  
25 casing part 10 between the inner face support 37 and the



exterior face support 27 when the holder 20 is closed. A flange 40 surrounds the body 38 and side and rear portions of the flange 40 are slidably engageable within the channel in the receiver 32. A handle 41 is provided at a front edge of the flange 40 for sliding the inner face support 37 in the receiver 32. An opening 43 is provided in the body 38 to expose those portions of the inner face 14 of the casing part 10 which are to be painted. A plate 45 is suspended within the opening 43 on overhanging arms 46 mounted on the flange 40, the plate 45 engageable with a surround of the opening 17 on the casing part 10.

As shown in Fig. 3 the bottom portion 22 of the frame is pivotally mounted on a ground engaging support 50 for pivoting about a vertical axis. This allows rotation of the frame to facilitate painting the casing part 10.

In use, the appropriate exterior face support 27 is mounted on the platform 26 on the bottom portion 22. A corresponding inner face support 37 has it's top side coated with a release agent which facilitates subsequent removal of paint overspray. The inner face support 37 is then slid into engagement with the receiver 32 and locked in position with the locking pins 39. With the top portion 23 in the open position as shown in Fig. 2 a casing part 10 is mounted on the exterior face support 27. The top portion 23 is then hinged down to clamp the casing part 10 between the exterior face support 27 and

the inner face support 37. The paint is then sprayed onto the inner face 14 of the casing part 10. It will be noted that the holder shields portions of the casing part 10 which are not to be painted and also rigidly holds the casing part 10 in a desired shape. Each casing part 10, which is mounted in the holder 20, is advantageously pulled into the same uniform shape when it is clamped in the holder 20. This corrects any irregularities between different casing parts 10. Advantageously also when the casing part 10 is mounted in the holder 20 an operator can readily easily visually check that there are no parts of the inner face of the casing exposed that should not be.

The invention is not limited to the embodiment hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. A method for producing an EMI shielded plastic casing part for an electronic device, comprising the steps:-

- 5 (a) mounting a plastic casing part in a holder with an exterior face of the casing part locating against a complementary shaped exterior face support on the holder,
- 10 (b) engaging an inner face of the casing part with a complementary inner face support on the holder, the inner face support covering desired portions of the inner face of the casing part,
- (c) rigidly clamping the casing part on the holder between the inner face support and the exterior face support,
- 15 (d) spraying an electrically conductive paint onto exposed surface portions of the inner face of the casing part,
- 20 (e) separating the inner face support and the exterior face support and removing the casing part from the holder,

(f) drying the paint on the inner face of the casing part,

5 (g) measuring the electrical resistance of the paint layer on the inner face of the casing part, rejecting any casing parts not having a preset desirable resistance value, and

(h) inspecting the casing part for defects and packaging the casing part if it is of acceptable quality.

10 2. A method as claimed in claim 1 including, after measuring the resistance value of the paint layer on the inner face of the casing part, the steps of mounting metal connectors onto associated plastics spigots projecting outwardly of the inner face of the casing part, then  
15 heating and flattening outer free ends of the spigots against the connectors to rigidly secure the connectors on the inner face of the casing part.

20 3. A method as claimed in claim 1 or claim 2 including the step of mounting protective covers over formations on the inner face of the casing part which are not to be painted prior to mounting the casing part in the holder, said covers being removed after resistance testing of the paint layer on the inner face of the casing part.

4. A method as claimed in any preceding claim wherein the electrically conductive paint is a nickel-rich paint.
5. A method as claimed in any preceding claim including the step of coating an outer side of the inner face support with a release agent prior to use of the holder to facilitate subsequent removal of paint overspray from the inner face support.
6. A method as claimed in any preceding claim including the step of printing indicia on an exterior of the cover part prior to inspecting and packaging the cover part.
7. A method for producing an EMI shielded plastic casing part for an electronic device substantially as hereinbefore described with reference to the accompanying drawings.
- 15 8. Apparatus for carrying out the method of any preceding claim including a holder comprising a rigid frame having a bottom portion and a top portion connected together by a hinge along one edge for movement between a closed position in which the top portion overlies the bottom portion and an open position, means for releasably mounting an exterior face support on the bottom portion and means for releasably mounting an inner face support

on the top portion and means to clamp the top portion against the bottom portion in the closed position to rigidly hold a casing part between the face supports.

- 5 9. Apparatus as claimed in claim 8 wherein the mounting means for the exterior face support is pivotally mounted on the bottom portion of the frame for pivoting about an axis which is substantially parallel to the axis of the hinge between the top portion and the bottom portion.
- 10 10. Apparatus as claimed in claim 8 or claim 9 wherein the mounting means for the exterior face support is height adjustable on the bottom portion.
- 15 11. Apparatus as claimed in any of claims 8 to 10 wherein the mounting means for the inner face support is a channel section receiver of U-shaped construction having a back part with two spaced-apart outwardly extending sides, an inwardly facing channel on the back part and sides for slidable reception of peripheral edges on three sides of an associated inner face support, and locking means to releasably lock the inner face support in engagement with  
20 the receiver.

12. Apparatus as claimed in claim 11 wherein the locking means is a pair of locking pins engageable with associated through holes at outer ends of the sides and with an inner face support mounted in the receiver to rigidly secure the inner face support in engagement with the receiver.
13. Apparatus as claimed in claim 12 wherein the locking pins are engageable with complementary through holes in the inner face support to secure the inner face support on the receiver.
14. Apparatus as claimed in any of claims 8 to 13 wherein the frame is pivotally mounted on a ground-engaging support for pivoting about a vertical axis.
15. Apparatus substantially as hereinbefore described with reference to the accompanying drawings.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9217755.9

**Relevant Technical fields**

(i) UK Cl (Edition K ) B2L

(ii) Int Cl (Edition 5 ) B05B 12/00

**Search Examiner**

M ELLIOTT

**Date of Search**

7 DECEMBER 1992

**Databases (see over)**

(i) UK Patent Office

(ii)

Documents considered relevant following a search in respect of claims 1-15

| Category<br>(see over) | Identity of document and relevant passages | Relevant to<br>claim(s) |
|------------------------|--------------------------------------------|-------------------------|
| A                      | US 4535722 A (KONDO) whole document        | 1 and 8<br>at least     |

SF2(p)

GEM - doc99\fil000603



| Category | Identity of document and relevant passages | Relevant to claim? |
|----------|--------------------------------------------|--------------------|
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